TB214440W

Reg. No :.....

Name :.....

B.Sc. DEGREE (C.B.C.S.) EXAMINATION, MARCH 2023

(2021 Admissions Regular, 2020 Admissions Supplementary / Improvement, 2019 &2018 Admissions Supplementary)

SEMESTER IV - COMPLEMENTARY COURSE 2 (PHYSICS)

(For MATHEMATICS)

PH4C01B18 - PHYSICAL OPTICS, LASER PHYSICS AND DIELECTRICS

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 mark (10x1=10)

1. Is law of energy conservation satisfied in the phenomenon of Interference? Briefly explain.
2. Mention any two applications of Interference.
3. Is it possible to observe Interference fringes with light from two independent light sources? Why?
4. Cite the assumptions made by Fresnel in explaining diffraction.
5. State the grating equation and explain the terms.
6. What are the uses of polaroids?
7. Distinguish between elliptically and circularly polarised light.
8. Briefly explain the relevance of metastable states.
9. Define the term population inversion.
10. How does a non polar molecule behave in the presence of an external electric field?
11. What do you mean by susceptibility of a dielectric medium?
12. Define Numerical aperture and give its significance.

Part B

II. Answer any Six questions. Each question carries 5 marks (6x5=30)

13. A glass fibre is made with core of refractive index 1.55 and cladding is doped to give a fractional refractive index change of 0.005. Find (a) the refractive index of the cladding (b) critical angle (c) acceptance angle and (d) numerical aperture.
14. Deduce the expression for radius of a dark Newton's ring.
15. In a plane diffraction grating the number of lines per cm is 5500. Find the angular separation between the wavelengths 546nm and 548nm in the second order.
16. Plane- polarized light is incident on a single polarizing disk with the direction of E_0 parallel to the direction of the transmission axis. Through what angle should the disk be rotated so that the intensity in the transmitted beam is reduced by a factor of 3.
17. Calculate the thickness of a doubly refracting plate capable of producing a path difference of $\frac{\lambda}{4}$ between ordinary and extraordinary rays. Given $\lambda = 5890\mathring{A}$.
18. A)At What temperature are the rates of spontaneous and stimulated emission are equal. Assume λ=500nm B)At what wavelength are they equal at 300K.
19. The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.059×10^{-30}. Find the wavelength of light emitted at temperature T=330K.

20. Discuss the process of electronic polarization in materials.
21. The dielectric constant of water is 78. What is its electrical permittivity?

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Discuss the theory of interference in thin films by reflected light.
23. Obtain an expression relating the electric field intensity, polarization vector and dielectric displacement vector of dielectric materials. Derive an expression connecting susceptibility and dielectric constant.
24. Discuss the production of linearly, circularly and elliptically polarized light using Huygen's theory of double refraction.
25. Compare and contrast the three level and four level pumping schemes citing lasers using each type.